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10/773,186	02/09/2004	Kia Silverbrook	MTB25US	8433

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EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

DATE MAILED: 07/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,186	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *2/9/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 4, 22, and 41 is withdrawn in view of the newly discovered reference(s) to Campbell et al. (US 4870433). Rejections based on the newly cited reference(s) follow.

The indicated allowability of claims 17, 36, and 53 is withdrawn in view of the newly discovered reference(s) to DeMoor et al. Rejections based on the newly cited reference(s) follow.

Claim Objections

Claims 1, 19, and 38 are objected to because of the following informalities: the recitation "the, or each bubble nucleation section" should read "each bubble nucleation section." Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5, 7, 12, 19-21, 24, 26, 31, 38-40, 42, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Andrews et al. (US 6568792 B2) in view of Campbell et al. (US 4870433).

Andrews et al. teach the following:

***regarding claims 1, 19, and 38**, an inkjet printhead and printing system (*col. 3, lines 26-30*) comprising:

a plurality of nozzles (*col. 6, lines 22-25*);

a bubble forming chamber corresponding to each of the nozzles respectively (*col. 1, lines 8-13*);

at least one heater element disposed in each of the bubble forming chambers respectively (*col. 1, lines 12-13*), the heater element configured for thermal contact with a bubble forming liquid (*col. 1, lines 13-16*); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 1, lines 13-17*); wherein, the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element (*col. 11, line 63 – col. 12, line 1*);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (*obvious to the operation of Andrews et al.'s invention*)

***regarding claims 2, 20, and 39**, the heater element extends between the electrodes mounted on opposite sides of the bubble forming chamber (*elements 140 and 132, Figure 1*)

***regarding claims 3, 21, and 40**, heating elements with a circular cross-section (*Figure 8*)

***regarding claims 5, 24, and 42,** the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 1, lines 8 and 13-17*)

***regarding claims 7 and 26,** the heater elements are in the form of a cantilever beam (*elements 712, 714, 716, Figure 8*)

Andrews et al. do not expressly teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements

***regarding claims 3, 21, and 40,** the bubble forming chamber has a circular cross-section.

***regarding claims 12, 31, and 48,** the bubble collapses to a point that is spaced from the heater element

Campbell et al. teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64)

***regarding claims 3, 21, and 40,** the bubble forming chamber has a circular cross-section (*unreferenced, circular, broken-line, Figure 1*) and that the heater elements have arcuate sections that are concentric with the circular cross-section (*resistor 12, Figure 1 with Figure 3*)

***regarding claims 12, 31, and 48,** a heater element that is configured such that the point of collapse of a bubble formed by the heater element is spaced from that heater element (*col. 3, lines 60-64*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Campbell's point of collapse into Andrews et al.'s invention. The motivation for doing so, as taught by Campbell, is to prevent cavitational erosion of the resistive heater elements so that reliability is improved (*col. 3, lines 64-66*).

Claims 1, 11, 19, 30, 38, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tachihara (US 5481287) in view of Campbell et al. (US 4870433).

Tachihara teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead and printing system (*col. 3, lines 16-18*) comprising:

a plurality of nozzles (*col. 3, lines 18-19*);

a bubble forming chamber corresponding to each of the nozzles respectively (*col. 3, lines 24-27*);

at least one heater element disposed in each of the bubble forming chambers respectively (*col. 3, lines 24-28*), the heater element configured for thermal contact with a bubble forming liquid (*col. 3, lines 38-40*); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 3, lines 24-31 with col. 3, lines 38-40*); wherein, the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element (*col. 3, lines 38-40*);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (inherent to operating the invention)

***regarding claims 11, 30, and 47**, the heater elements have two opposite sides and are configured such that a gas bubble formed by the heater element is formed at both sides of that element (*Figure 6B*)

Tachihara does not expressly teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements

Campbell et al. teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Campbell's point of collapse into Tachihara's invention. The motivation for doing so, as taught by Campbell, is to prevent cavitational erosion of the resistive heater elements so that reliability is improved (*col. 3, lines 64-66*).

Claims 1, 6, 8, 10, 13, 14, 19, 23, 25, 27, 29, 32, 33, 38, 43, 44, 46, 49, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of Andrews et al. (US 6568792 B2) and Campbell et al. (US 4870433).

Silverbrook teaches the following:

***regarding claims 1, 19, and 38,** an inkjet printhead (*col. 5, lines 34-38*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*nozzles 41, Figure 3*);

a bubble forming chamber corresponding to each of the nozzles respectively (*element 113, Figure 9*);

at least one heater element disposed in each of the bubble forming chambers respectively (*elements 120, Figure 9*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); and

supplying the nozzle with a replacement volume of ejectable liquid equivalent to the ejected drop (*col. 12, lines 59-61*)

***regarding claims 6, 25, and 43**, the printhead is configured to print on a page and that the printhead is a page-width printhead (*col. 2, lines 19-20*)

***regarding claims 8, 27, and 44**, each heater element is configured such that an actuation energy of less than 500 nanojoules is required to be applied to the heater element to heat the heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29, and 46**, the printhead comprises a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm:* $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$)

***regarding claims 13, 32, and 50**, the printhead comprises a structure that is formed by chemical vapor deposition (*col. 5, lines 46-48*), the nozzles being incorporated on the structure (*CVD layer 80 about nozzle 77, Figure 4b*)

***regarding claim 14, 33, and 49**, the printhead comprises a structure that is less than 10 microns thick, the nozzles being incorporated into the structure (*col. 9, lines 8-10*)

***regarding claim 23,** the system is configured to support the bubble forming liquid that is in thermal contact with a heater element (*ink 106 supported next to heater 120, Figure 24*) and to support the ejectable liquid adjacent each nozzle (*ink 106 supported next to nozzle 111, Figure 24*)

Silverbrook does not expressly teach the following:

***regarding claims 1, 19, and 38,** the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element; and

the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements

Andrews et al. teach the following:

***regarding claims 1, 19, and 38,** the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element (*col. 11, line 63 – col.12, line 1*)

Campbell et al. teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Andrews et al.'s heater element cross sections and Campbell et al.'s point of collapse into Silverbrook's. The motivation for doing so, as taught by Andrews, is to vary the resistances of the heater elements so that different heater elements may fire droplets of fluid at different times (*col. 12, lines 2-6*). The motivation for doing so, as taught by Campbell, is to prevent cavitational erosion of the resistive heater elements so that reliability is improved (*col. 3, lines 64-66*).

Claims 1, 6, 7, 15, 16, 18, 19, 25, 26, 34, 35, 37, 38, 43, 51, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anagnostopoulos et al. (US 6502925 B2) in view of Andrews (US 6568792 B2) and Campbell et al. (US 4870433).

Anagnostopoulos et al. teaches the following:

***regarding claims 1, 19, and 38,** an inkjet printhead (*col. 7, lines 34-36*) and a printing system (*col. 7, lines 14-15*) comprising:

a plurality of nozzles (*col. 5, lines 17-21*);

a bubble forming chamber corresponding to each of the nozzles respectively (*col. 5, lines 20-22*);

at least one heater element disposed in each of the bubble forming chambers respectively (*col. 5, lines 22-25*), the heater element configured for thermal contact with a bubble forming liquid (*col. 5, lines 22-25*); such that

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 1, lines 37-41 in combination with col. 4, lines 22-25*); and

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the operation of Anagnostopoulos et al.'s invention)

***regarding claims 6, 25, and 43,** the printhead is configured to print on a page and to be a page-width printhead (*col. 3, lines 35-39*)

***regarding claims 7 and 26,** each heater is in the form of a cantilever beam (*TiN heater, Figure 5*)

***regarding claims 15, 34, and 51**, the printhead comprises a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 5, lines 17-23*), and a plurality of the heater elements are disposed within each chamber (*col. 8, lines 36-37*), the heater elements within each chamber being formed on different respective layers to one another (*col. 8, lines 36-38*)

***regarding claims 16, 35, and 52**, each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54**, each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

Anagnostopoulos et al. do not expressly teach the following:

***regarding claims 1, 19, and 38,** the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element; and

the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements

Andrews et al. teach the following:

***regarding claims 1, 19, and 38**, the heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of the heater element (*col. 11, line 63 – col.12, line 1*)

Campbell et al. teach the following:

***regarding claims 1, 19, and 38,** the gas bubble collapses to a point of collapse that is spaced from any solid surface of the heater elements (col. 3, lines 60-64)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Andrews et al.'s heater element cross sections and Campbell et al.'s point of collapse into Anagnostopoulos et al.'s invention. The motivation for doing so, as taught by Andrews, is to vary the resistances of the heater elements so that different heater elements may fire droplets of fluid at different times (*col. 12, lines 2-6*). The motivation for doing so, as taught by Campbell, is to prevent cavitational erosion of the resistive heater elements so that reliability is improved (*col. 3, lines 64-66*).

Claims 17, 36, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by Campbell et al. (US 4870433), and further in view of DeMoor et al.

Silverbrook as modified by Campbell et al. teach the following:

***regarding claims 17, 36, and 53,** each heater element includes solid material and is heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 9, lines 26-28 of Silverbrook*)

Silverbrook as modified by Campbell et al. do not expressly teach the following:

***rearding claims 17, 36, and 53,** the heater element is configured for a mass of less than 10 nanograms to be heated

DeMoor et al. teach the following:

***rearding claims 17, 36, and 53,** the heater element is configured for a mass of less than 10 nanograms to be heated (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook as modified by Campbell et al. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Communications with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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SLF

7/04

K. FEGGINS
PRIMARY EXAMINER